ON THE PRESENT STATE OF KNOWLEDGE IN BACTERIAL SCIENCE IN ITS SURGICAL RELATIONS.

(Continued from Page 333.)

PYÆMIA—ERYSIPELAS.

Pyæmia.—According to the latest investigators of pyæmic affections it appears, as if from a strictly bacteriological point of view there were no distinction to be made between sepsis and pyæmia. Rosenbach[1], who examined six cases of typical pyæmia with a view to determining the nature of the micro-organisms present in pyæmic subjects, found the *streptococcus pyogenes* present in five of the cases, partly in the blood, partly in the metastases. Twice *staphylococci* were present as well, although in fewer numbers; and once he found only *pyogenic staphylococci* alone, and that in a very typical case of pyæmia.

Comparing these results with the cultures obtained from septic diseases, including phlegmons, abscesses and progressive tissue-gangrene, he was able to trace no difference whatever between the two diseases, as far as micro-organisms are concerned.

In observations preceding this publication, however, there is no lack of assertions, that bacilli are to be found in the blood and organs of pyæmic subjects, and this was once a very favorite theory.

Betzow[2], who examined some cases of pyæmia post-mortem found cocci, bacilli and leptothrix present. But since his methods did not include culture-experiments, and his observations were not made till fifteen or twenty hours after death, his deductions need corroboration.

It is not improbable, however, that other pyogenic micro-organisms will become better known in the future, and since pyogenic bacilli have already been described and figured, it is quite possible that some of these species may also be proved to be a cause of pyæmia in man. At present, however, we have not even an analogy to such a disease in animals, the typical cases of pyæmia in rabbits described by Koch [1] being due to a micro-coccus.

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[1] Microorg, bei den Wundinf. Krankh. des Mensch, Wiesbaden. 1884.

[2] Centralblatt für medic. Wissensch. No. 22. 1884.

It is of importance to note, also, that Schüller [2], who examined the metastases in twelve cases of puerperal fever, found only *strepto-cocci* and *single* and *diplo-cocci*, but never bacilli, in the inflamed joints.

The question why the same micro-cocci produce pyæmia, that is to say localized metastases, at one time, and at another, sepsis or non-localized general intoxication alone, cannot be satisfactorily treated with our present knowledge of the subject.

Erysipelas.—Before Fehleisen's celebrated work appeared the ætiology of erysipelas was problematical and obscure.

Micrococci had been frequently found in erysipelatous affections, but since experiments had been published to prove that inoculations with erysipelatous matter containing micrococci, did not always produce erysipelas, even in the same animal species, and again, that erysipelas could often be communicated although no micrococci were present, as, for instance, by the contents of the erysipelatous bullæ, no definite knowledge was arrived at. Max. Wolff [3] concluded from a review of the subject and a number of original observations, that certain micrococci produced some chemical poison which occasioned erysipelas. The distinction, moreover, between erysipelas and phlegmonous processes was formerly not accurately made, and Tillmanns [4] even believed that erysipelas germs could produce septic diseases.

And yet Orth [5], as long ago as 1874, had cultivated erysipelatous bacteria in nutrient solutions and had successfully inoculated them from thence. Had his methods possessed all the advantages of those of the present day, his experiments would have had more importance attached to them.

Koch described the specific organisms of erysipelas as small micrococci of globular shape, united in pairs or forming short chains, and published photographic representations of them, both in the first volume of the Communications of the Imperial Board of Health and in his work on the infectious diseases of wounds, where he also historically refers to former researches.

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[1] Untersuch. üb. d. Aetiol. der Wundinfections Krankh. Leipzig. 1878.

[2] Ueber Bacterien bei metastat. Gelenkentzünden, Verahndlgn d. Deutsch. Ges. f. Chirurg. 13. Congress. April, 1884. Berlin.

[3] Bacterienlehre bei accidentellen Wund-Krankheiten. Virchow's Archiv. Vol. 81. P. 408.

[4] Archiv. für klin. Chirurg. Vol. 23. P. 437.

[5] Archiv. für experiment. Patholog and Pharm. Vol. I, p. 81.

Fehleisen, however, was the first to cultivate the micrococci in pure cultures on hard soils[1], and to inoculate human subjects with these cultures. Examining thirteen cases of erysipelas (two of which subsequently died), and excising pieces of skin from eleven of these, this author always obtained the same results and found chains of micrococci in the lymphatics of the cutis and of the areolar and fatty tissue beneath, and especially in those of the superficial layer of the corium.

The micrococci were not to be found in the capillaries or blood-vessels; nor were they present in cases of lymphangitis. They were most frequent in the parts most recently affected; while the bullæ contained in their serum great numbers of other micrococci and bacilli, but no specific erysipelas-cocci, or only such as had lost their vitality.

The culture-experiments were made upon gelatinised infusion of meat, and were continued to the fourteenth generation in a space of two months. These cultures were subsequently repeated and approved by Koch himself and Gaffky.

Inoculations made at the tip of the ear in rabbits produced erysipelatous inflammation which subsequently spread to the root of the ear, with all the specific accompanying symptoms. The inoculations of human subjects were performed as a therapeutic measure; such a procedure being deemed justifiable in consideration of Busch's results, who had achieved a complete cure of malignant lymphatic tumors by means of placing the patient in a bed which was known by experience to convey erysipelatous infection to the occupant.

Consequently six inoperable cases of tumor were chosen on which to try the experiment, which proved not unsuccessful.

The first case was one of multiple fibro-sarcoma. Inoculation with the pure culture matter produced typical erysipelas, commencing with a rigor and lasting for two weeks. A collapsed condition of the patient on the sixth day, however, had the effect of demonstrating the danger of the proceeding. In this case the cure was incomplete.

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[1] Die Ætiologie des Erysipelas. Berlin. 1883. Th. Fischer. In its first part this book contains a full historical account of the views formerly current on the nature of erysipelas, and review of the bacterial data and theories.

The second case, however, one of recurrent carcinoma of the mammary gland, that had been twice operated upon, proved more successful. Here, too, the infection with the pure cultures was followed by a rigor; the bodily temperature rose to 40.5° C., and the inflammation extended over the whole chest and abdomen. After two weeks the process had subsided, but pleuritis had set in as a complication of the disease. The hard carcinomatous growths had *entirely disappeared.*

In other cases, a recurrent sarcoma of the orbita in an eight-year old girl, and two inoperable cases of mammary carcinoma, the inoculation produced no marked improvement; but one case of facial lupus, on the other hand, was completely cured. In all cases the disease ran a typical course; the time of incubation varied from fifteen to sixty-one hours. A period of immunity of short duration also appeared to exist. One man who had had an attack of erysipelas a few months before, was inoculated twice without result. And in the case mentioned of the girl suffering from orbital sarcoma a second inoculation after lapse of of two weeks "did not take." The patient with lupus of the face, on the other hand, had had erysipelas nine months before.

These results, as Koch points out in his review of the book [1], prove beyond doubt the parasitic nature of the erysipelas-micrococci, which was not previously understood.

Fehleisen also experimented with antiseptic solutions upon his erysipelas-cultures, and found that a three per cent solution of carbolic acid had no effect upon the micrococci for twenty seconds; after thirty seconds inhibitory action was noticed, and after 40 seconds their vitality was destroyed. One pro mille sublimate solution killed them in ten or fifteen seconds.

Fehleisen demonstrated the micrococci and their effects at the Surgical Congress at Berlin in April, 1883.

In regard to the therapeutic employment of erysipelas-cultures, a publication of Dr. Janicke and Prof. Neisser, of Breslau,[2] should here be mentioned, where description is given of a patient suffering from inoperable carcinoma of the breast, who was treated by inoculation with the specific micrococci in hopes of producing a cure, but who died from the effects of the infection. The autopsy revealed destruction of the proper cells of the growth without suppuration. The material for inoculation was procured from Fehleisen's laboratory. The disease commenced with a rigor, followed by a rise of temperature over 40° C. The rash extended over the whole chest, the shoulder and axilla, with temperatures up to 41° C on the first day. Subsequently it spread over the whole abdomen, the whole arm and half of the arm of the opposite side. Death occurred in collapse on the fourth day, the temperature not having gone below 40.4° C, and the pulse remaining between 120 and 140. Before death occurred the tumor had visibly decreased in size and the swollen lymphatic glands had become much smaller and softer. A detailed microscopical post-mortem examination is appended by Prof. Neisser.

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[1] Fortschritte der Medicin. Vol. I. P. 168.

[2] Exitus letalis nach Erysipelimpfung bei inop. Mamma-carc. und microsc. Befund des geimpften. carc. von Dr. O. Janicke und Prof. A. Neisser, in Breslau. Centrlbl. f. Chir. 1884. P. 401.

The present writer also had the opportunity of observing a case of inoperable recurrent sarcoma of the neck in an adult which was treated by erysipelatous inoculation by Geh. Rath Thiersch, of Leipsic, but without curative effect.

Fehleisen's specific micrococcus of erysipelas is in character a strepto-coccus. Now, as we have described a pyogenic or pus-forming streptococcus found by Rosenbach and Passet in pus of osteomyelitic and phlegmonous origin,[1] it becomes necessary to distinguish between the two kinds. Hoffa, of Prof. Maas' surgical clinic at Würzburg has recently pointed out some points of differentiation between the two [2].

The two species of micrococci cannot be distinguished with the microscope alone. Both kinds form chains of two or more cocci, varying in size from 0.3 to 0.6 μ; the chains being either straight or curved or S-shaped. In gelatine soils kept at a temperature of 24° C, a delicate transparent greyish-white halo appears around the inoculation puncture upon the surface during the first day, while light grey minute specks and dots are to be seen in the course of the puncture. The halo undergoes no subsequent change, but the light points materially increase in size during the next twenty-four hours.

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[1] This volume. Pages 224 and 332.

[2] Fortschritte des Medicin. Vol. IV. P. 75. Feb.

But in plate-cultures on agar-agar soils, kept at a temperature of 37° C, in which the first phases of development exactly correspond to the above description, a difference manifests itself after forty-eight hours. The colonies of the specific cocci of erysipelas develop considerably faster than those of the pyogenic cocci. The latter soon present the light brown color in the raised centre and the ridge around the edge; but the former show neither of these criteria. According to Rosenbach the later stages of plate-cultures of the erysipelas-cocci resemble fern leaves in shape, those of the pyogenic-cocci those of the acacia tree; but Hoffa believes these differences only due to variations in the state of humidity of the soils.

The question whether abscesses and suppuration of neighboring joints in cases of erysipelas are produced by the specific micrococcus of erysipelas or by the pyogenic micrococcus is rendered very difficult of decision by the similarity of the two varieties. Schüller,[1] who found micrococci resembling Fehleisen's cocci in metastatic suppuration of the knee-joint in a case of erysipelas, did not apply the culture tests.

Hoffa, however, was able to demonstrate the presence of Fehleisen's specific micro-coccus in a purulent gonitis occurring in a case of erysipelas migrans[2] beyond a doubt, and accounts for the infection by the anatomical relation which exists between the lymphatics and the joints.

But whether or not Fehleisen's specific micrococcus can produce suppuration, which Klemperer[3] denies, is a question to be definitely solved in the future.

W. W. Van Arsdale.

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[1] Report of the German Surgical Society. 13th Congress. Berlin. April, 1884.

[2] L. C. P. 78.

[3] Ueber die Beziehung der micro-organismen zur Eiterung. Zeitschrft. f. Klin. Med. Vol. X. P. 158.